AVHRR Solar Channel Calibration Fundamental CDR Using Multiple Methods

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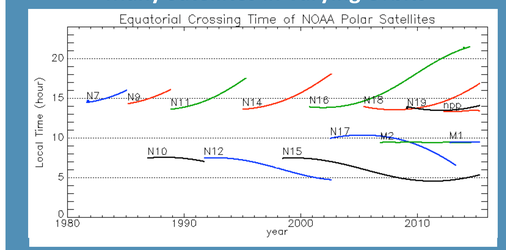
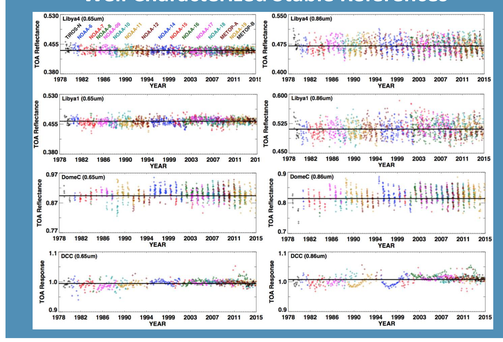
CDR Images

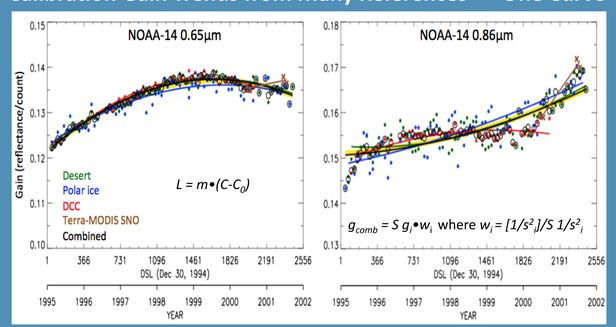
Many Satellites in Varying Orbits



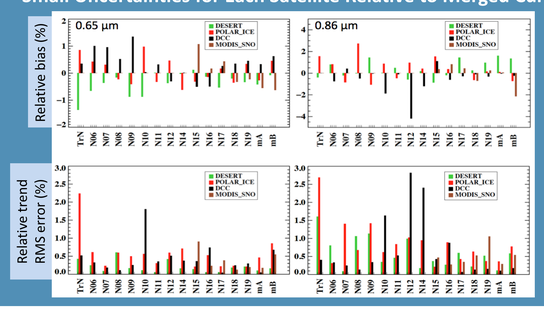
Well Characterized Stable References



Calibration Gain Trends from Many References => One Curve



Small Uncertainties for Each Satellite Relative to Merged Curve



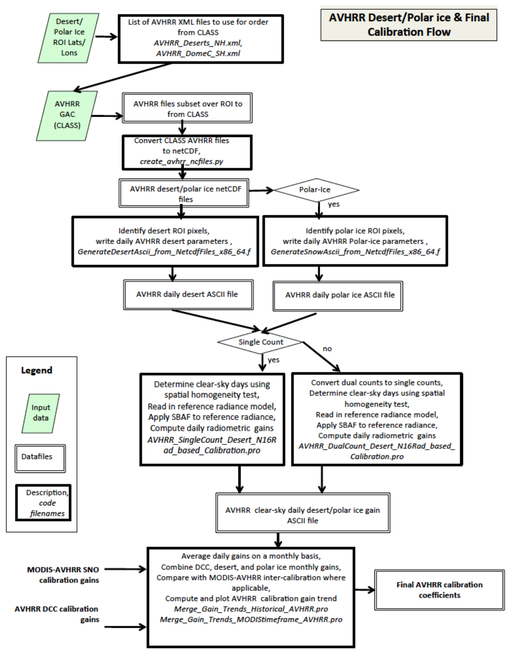
CDR Description

Calibration FCDR Specifications

- Gains produced monthly using 5 methods
  - Desert, Polar snow invariant targets (IT)
  - Deep convective clouds (DCC)
  - Simultaneous Nadir Overpass (SNO) w/ Aqua MODIS
  - Merged DCC & IT results
- Monthly mean gains, *g*, 1978-2012
- Polynomial fits to monthly means, fn(*dsl*)
  - $m = m_0 + m_1 \bullet dsl + m_2 \bullet dsl^2$

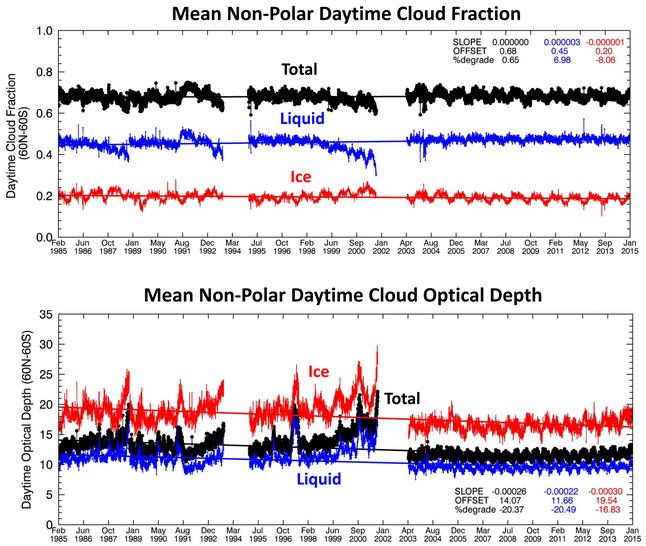
Inputs to Calibration FCDR

- Re-navigated Advanced Very High Resolution Radiometer (AVHRR) 0.63, 0.86, and 1.6-µm brightness counts, *C*
- Observational geometric conditions, date
- Invariant site reflectance models, SBAFs
- DCC BRDF models
- Spectral solar constant, launch date, C_o



Example of CDR Applications

Determining Trends in Cloud Properties

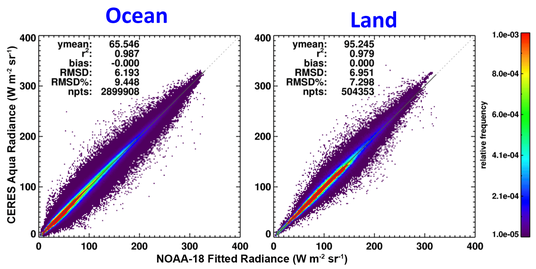


Above: Trends from N-09 to 19. Anomalous trend in cloud fraction/phase selection follows orbit drift. COD different for pre-NOAA-16 vs post-NOAA-16 satellites, feedback for calibration team.

Applications

This FCDR has just been delivered so applications are currently only within the LaRC cloud/radiation TCDR/FCDR groups. Potential applications are many.

Estimating Shortwave Broadband Albedo



Above: New parameterization developed matching NOAA-18 with CERES broadband shortwave measurements. Uses 2 channels and has multiple angle dependencies. Accurate calibration of 0.63 & 0.86-µm channels over 35+ year record will provide a unique CERES-like albedo product.

Future Improvements and Anticipated Applications

Development & Improvements

- Perform AVHRR AM/PM SNO calibration to validate merged calibration between AM/PM satellites
- Test sensor and band specific polynomial fits with varying number of orders to more accurately describe the calibration drift not captured in simple quadratic fit
- Improve strategy of combining Greenland summit (NH) and Dome-C (SH) observations
- Increase DCC calibration accuracy by ensuring a stable cross-sensor 205 K BT using AVHRR AM/PM SNOs
- Improve DCC BRDF accuracy for SZA greater than 60° by using selective viewing angles
- Use 0.86-µm DCC BRDFs: need for band specific DCC BRDFs demonstrated by PARASOL data
- Monitor cross-sensor global mean optical depth retrievals: allows all Earth observed reflected radiances to be evaluated as a whole
- Determine & correct source of cloud optical depth difference between AVHRR/2 and 3 sensors

Potential Applications

Calibration Needed for Any Daytime Parameter

- Aerosol Optical Thickness & Type
- Surface Albedo
- Radiation Budget
- Solar Energy
- Vegetation Index
- Ocean Properties / Wind Speed (sunglint area)
- Snowpack
- Flood Monitoring
- Land Use/Cover Type (i.e. burn areas)
- Calibration Transfer to Other Satellites